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SPECTRAL ESTIMATION TECHNOLOGY.(U)
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FINAL REPORT

Spectral Estimation Technology

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Spectral Estimation Technology

The basic task being examined under this grant is that of estimating the spectrum of a wide-sense stationary time series $\{x(n)\}$. This estimation is to be based on the following set of N time series observations

$$x(1),\ x(2),\ \cdots,\ x(N) \qquad (1)$$

which are made available through some measurement mechanism. The spectral density associated with such a time series is characterized by

$$S_x(w) = \sum_{n=-\infty}^{\infty} r_x(n)\ e^{-jwn} \qquad (2)$$

where $r_x(n)$ denotes the autocorrelation of the time series under analysis.

An examination of expression (2) reveals that the spectrum is dependent on the infinite set of autocorrelation parameters $r_x(n)$ which are not generally available. In order that one use the finite set of time series observations (1) to estimate the infinite parameter spectral density (2), investigators have generally hypothesized a finite parameter model for the spectrum. The most general linear model is the so-called autoregressive-moving average (ARMA) as specified by

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$$\hat{S}_x(w) = \left| \frac{b_0 + b_1 e^{-Jw} + \cdots + b_q e^{-Jqw}}{1 + a_1 e^{-Jw} + \cdots + a_p e^{-Jpw}} \right|^2 \qquad (3)$$

During the two month period of this grant, the principle investigator and his graduate research assistant developed an adaptive method for optimally updating the autoregressive coefficients (i.e., the a_k) of the ARMA model as new observations are made avaliable. This updating algorithm is predicated on making use of a "restricted" set of Yule-Walker equations which governs the ARMA models time domain description. This algorithm will be dependent on a projection operator formulation. The details of this procedure will be reported upon in a forthcoming publication. [1]

References

[1] J.A. Cadzow and R.L. Moses, "Data Adaptive ARMA Modeling of Time Series," to be presented at the 1982 International Conference of Acoustices, Speech, and Signal Processing. Paris, France.

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During the two months period of this grant, the principle investigator and his graduate research assistant developed an adaptive method for optimally updating the autoregressive coefficients of the autoregressive - moving average (ARMA) model as new observations are made avaliable. This updating algorithm is predicated on making use of a "restricted" set of Yule-Walker equations which governs the ARMA model's time domain description. This alogorithm will be dependent on a projection operator formulation.

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The details of this procedure will be reported upon at the forthcoming, 1982 International Conference of Acoustics, Speech, and Signal Processing in Paris.